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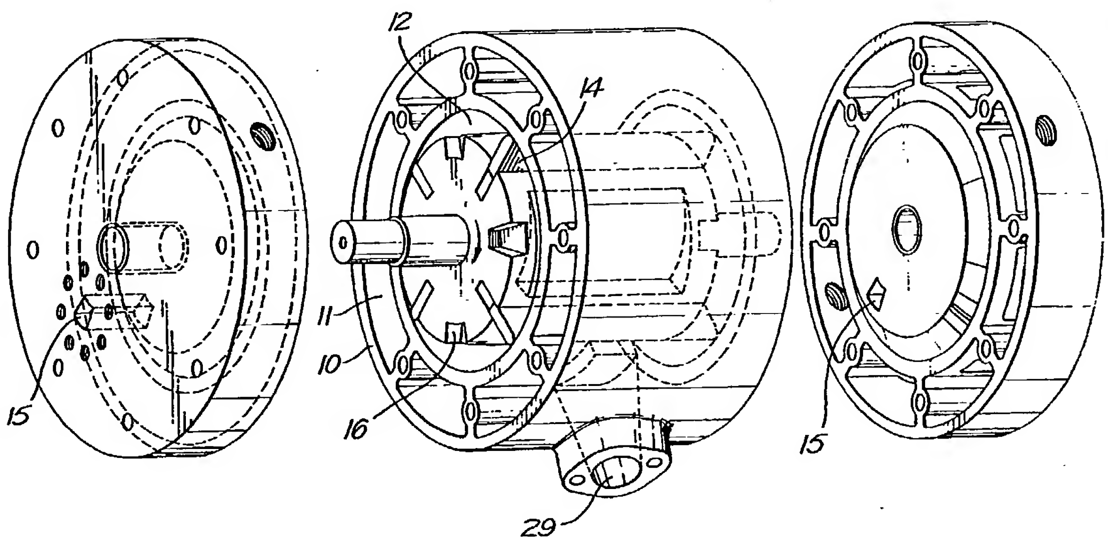
(54) A rotary internal-combustion engine

(57) The engine has a rotor furnished with sliding vanes 14 and eccentrically mounted in a cylindrical chamber 12 within a housing 10, an air or gas inlet port(s) 15, an exhaust port 29, means to supply fuel to the chamber e.g. a nozzle (17), Figure 2 (not shown), and a compressor to pressurise the air or gas supplied to the inlet port(s). The compressor may be of the sliding-vane type, Figure 3 (not shown), and be driven directly by the rotor.

Fig.1.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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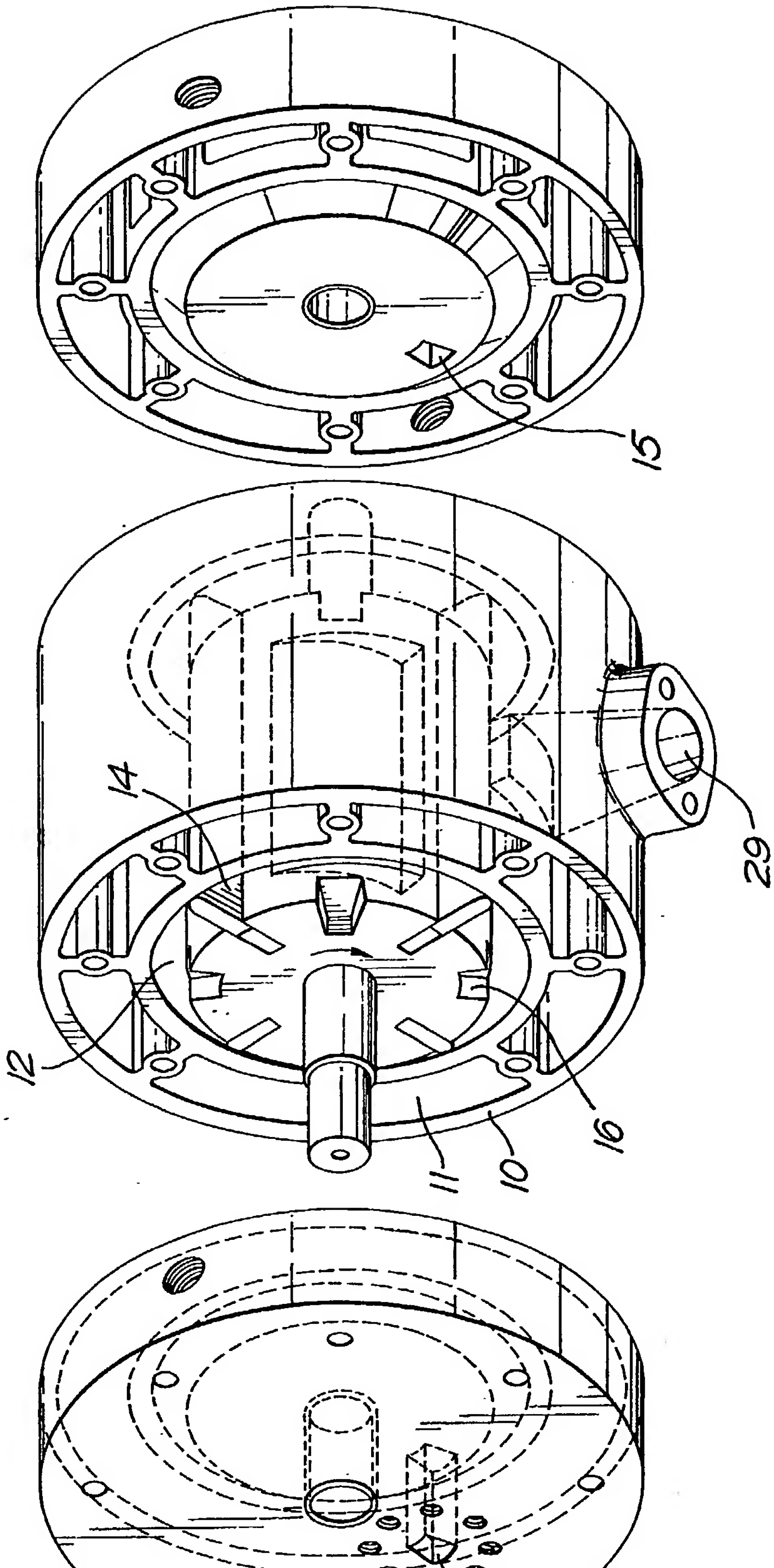


Fig.1.

Fig.2.

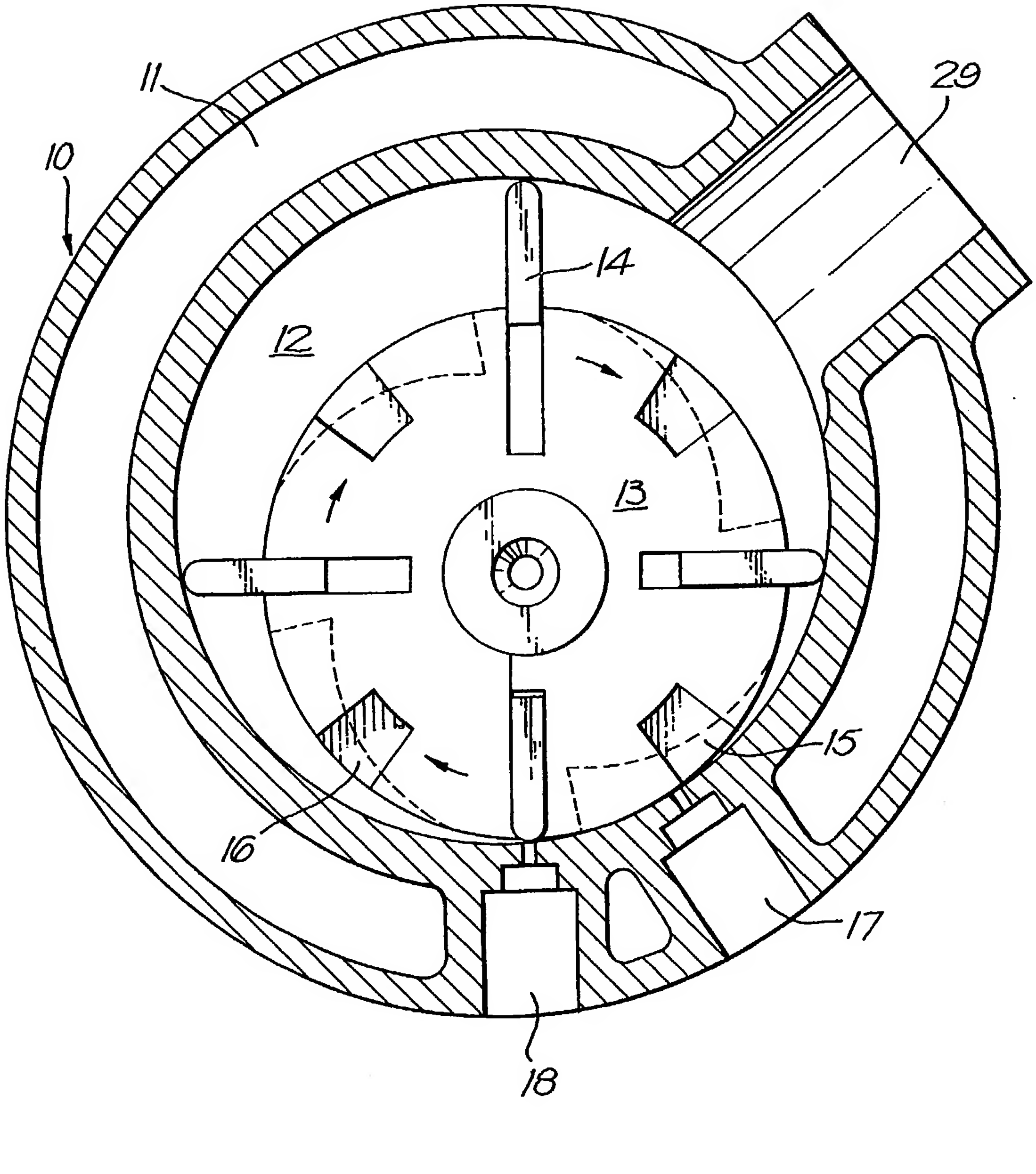
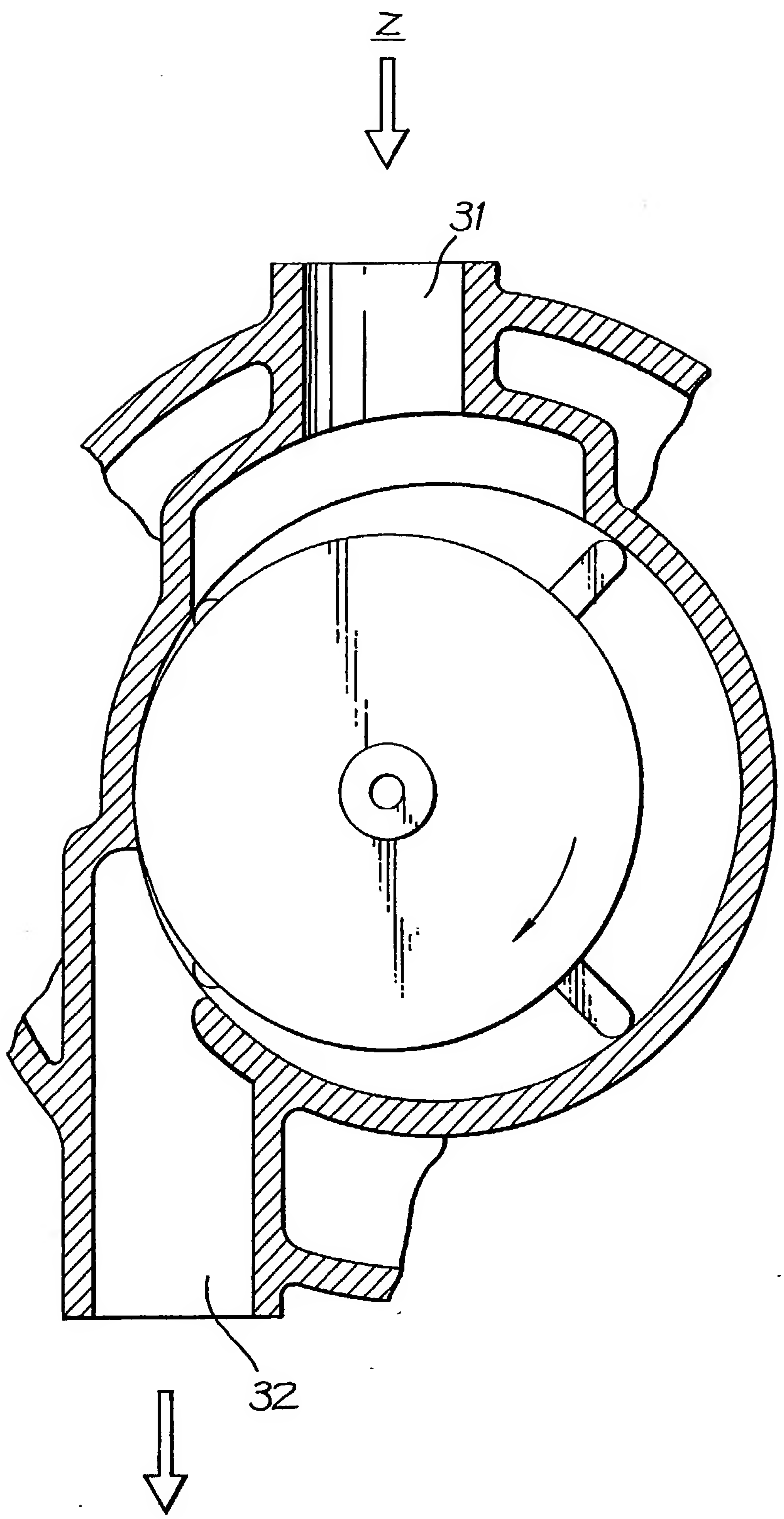


Fig.3.



SPECIFICATION

A rotary engine

The present invention relates to a rotary engine.

According to the present invention there is provided a rotary engine having a rotor eccentrically mounted in a cylindrical housing, radially movable vanes on the rotor engaging the inner wall of the housing to define rotatably movable chambers of variable volume, an inlet port extending through the housing at a position at which, upon rotor rotation, the adjacent chamber approaches its smallest volume, an exhaust port extending through the cylindrical housing at a position at which, during rotor rotation, the adjacent chamber has just passed its maximum volume, means to provide fuel to the chambers and a compressor to supply pressurised air or gas to the inlet port.

Preferably there are two inlet ports, and preferably the or each inlet port opens axially of the housing so as to reduce the speed of inlet air or gas flow, improve scavenging of exhaust gases and to make the handling of large volumes of air or gas flow easier. Preferably the compressor is driven directly by the ending.

Either spark or compression ignition can be employed, although in general spark ignition is preferred because it is easier to arrange the two stage compression such that the temperatures required for compression ignition are not reached in the engine.

The arrangement is preferably such that ignition in each chamber will occur just before that chamber has passed its minimum volume. Fuel injection, if employed, will preferably occur just before the minimum volume is reached although in certain embodiments fuel can be supplied with the air, the means to provide fuel then being a carburettor or fuel injector at the inlet to the compressor.

The use of the compressor means that pressurised air can be fed into the chambers, the air being further pressurised in the chambers before combustion takes place. Accordingly the efficiency is improved. It is envisaged that air at 100 to 200 pounds per square inch pressure will be fed into the chamber and will be compressed by a factor of 2 when in the combustion chamber. This effective two stage compression means that the problem of heat generated during compression is reduced in that heat can be dissipated between the compressor and the inlet port to the engine and spontaneous uncontrolled pre-ignition can be eliminated. Further, the compression ration can be made variable, for instance by varying the internal volume of the manifold between the compressor and inlet to the engine.

Preferably there are four vanes and four chambers, the pairs of vanes on the same diameter preferably being integral with one another.

In order that the invention may be more clearly understood, the following description is given by way of example only with reference to the accompanying drawings in which:

Figure 1 is a perspective exploded view of one engine of the invention with the compressor not shown;

Figure 2 is an axial cross-sectional view of the engine of Figure 1;

Figure 3 is a part sectional view of a compressor for use in the engine of the invention.

As best shown in Figure 2, the engine comprises a housing 10 with a liquid cooling jacket 11 surrounding a cylindrical interior 12 in which is eccentrically mounted a rotor 13 having four radial vanes 14. The vanes are arranged in pairs, the two vanes on a diameter being integral with one another and they define four chambers of variable volume corresponding to the inter-vane areas numbered 1, 2, 3 and 4. Extending axially through each of two end covers of the housing air inlet ports 15 to be supplied by a compressor to feed air or gas into the housing. In the edge of the rotor at each end, and mid way between each adjacent pair of vanes is a notch 16 which is arranged to register with the inlet port 15 once during each revolution and to form part of each chamber. These notches function, with the inlet ports, as inlet valves. The notches and each inlet port span about 15 degrees of the rotor circumference, so that the period of induction is about 30 degrees of rotor shaft rotation. It will be apparent that registration between the notch and inlet occurs as the chamber concerned is reducing in volume, and in fact it will again half in volume before reaching the position of minimum volume. In the embodiment shown, shortly after the air inlet in the direction of rotation, injection of fuel will occur via fuel inlet nozzle 17 and this will be followed by ignition brought about by sparking plug 18. The combustion and resultant expansion drives the rotor which when at its maximum volume comes into register with an exhaust port 29 in the side of the housing.

As shown the exhaust port is shut off again before the inlet is open but in fact, when fuel is injected directly into the combustion chamber, it is preferable to have a slight overlap between the inlet and exhaust valves, in that for a short time, e.g. about 5 degrees of rotor rotation, they are both open to a given chamber. This will improve the scavenging effect. Sparking will occur just before the minimum volume position is reached and the combustion and expansion stroke occupies about half of a revolution. The fuel injection and spark plug positions are at 17 degrees either side of the dead centre minimum volume position for a particular chamber.

Coincidence of the notches and inlet ports works as a valving arrangement alone, no other valving necessarily being provided for the inlet air or gas. Likewise exhaust valving operating occurs simply by the passage of the vanes passing the exhaust port.

Fuel can be injected as shown or it can alternatively be supplied to a manifold by which the air is supplied to the engine. Further, it can be supplied to the inlets of the compressor with a suitable carburettor or fuel injection system. Of course, with diesel fuel the spark plug is omitted and injection takes place into the compressed air when at or near its minimum volume in the chamber. Lubricating oil can be inserted into the inlet port of the compressor or mixed with the fuel, and is preferably also circulated via a cooling reservoir by an engine driven pump and through internal cavities in the rotors of

both engine and compressor so as to lubricate and cool those parts. The water jackets have been described and will preferably be used with a circulation pump and radiator in the well known way. The compressor and the manifold from it to the air inlet can also be cooled in a similar way and for air cooling purposes, radiating fins can be provided on the housing and compressor.

If fuel is added to the air at the compressor inlet, then additional mixing thereof with the air will occur before feeding to the chamber. However, because there is an opportunity for cooling the air between the two compression stages pre-ignition can be avoided. Alternatively, the fuel can be added to the air in the chamber and with diesel fuel this will of course be necessary and the sparking plug will be omitted.

According to a preferred feature, the manifold connecting the compressor to the main part of the engine is variable in volume so that the compression ratio of the engine can be adjusted.

To make the combustion and expansion stages particularly effective it is possible, as schematically suggested in Figure 2, to provide in the rotor in each chamber, a saw tooth shaped recess in the rotor which has a radial edge near the leading vane of the chamber concerned. This means there are two radial faces against which the expansion of the gases acts.

All the internal wearing surfaces of the engine can be constructed of an alloy steel preferably chromium plated or with carbide coating. The tips of the rotors, the sides and other sealing areas and seals should be of a carbon alloy, the outer casing surrounding the water jackets and cooling fins can be of cast iron or aluminium alloy and the manifold leading from the compressor to the engine is preferably also a steel casting

Figure 3 schematically illustrates the compressor itself, this being of known construction having sliding vanes in a rotor eccentrically mounted in the cylindrical or near cylindrical housing. The inlet is shown at 13, the outlet at 31 and a water jacket surrounds the housing. The rotor can be driven directly by the engine shaft or via a gear train.

The engine can be designed specifically, as desired, to operate with petrol, parafin, diesel oil, combustion gases and combustion fuel oils and gases.

CLAIMS

1. A rotary engine having a rotor eccentrically mounted in a cylindrical housing, radially movable vanes on the rotor engaging the inner wall of the housing to define rotatably movable chambers of variable volume, an inlet port extending through the housing at a position at which, upon rotor rotation, the adjacent chamber approaches its smallest volume, an exhaust port extending through the housing at a position at which, during rotor rotation, the adjacent chamber has just passed its maximum volume, means to provide fuel to the chambers and a compressor to supply pressurised gas or air to the inlet port.

2. A rotary engine according to claim 1, wherein the compressor is directly driven by the engine.

3. A rotary engine according to claim 1 or 2, wherein the inlet port is axial of the housing.

4. A rotary engine according to claim 1, 2 or 3, wherein there are two inlet ports.

5. A rotary engine according to any preceding claim, wherein the means to provide fuel includes a fuel injection port adjacent the inlet.

6. A rotary engine according to any preceding claim, wherein, during rotation, each chamber communicates with both the inlet and exhaust ports for a short time.

7. A rotary engine according to any one of claims 1 to 4, wherein the means to provide fuel are located at the inlet of the compressor.

8. A rotary enging according to any preceding claim, including a sparking plug.

9. A rotary engine according to any preceding claim, including, in the rotor and within each chamber, a recess having a radial edge at the end thereof which leads in the direction of rotation.

10. A rotary engine according to any preceding claim, wherein the housing is provided with a cooling jacket.

11. A rotary engine contructed and arranged, substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings.

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ABSTRACT:

The engine has a rotor furnished with sliding vanes 14 and eccentrically mounted in a cylindrical chamber 12 within a housing 10, an air or gas inlet port(s) 15, an exhaust port 29, means to supply fuel to the chamber e.g. a nozzle (17), Figure 2 (not shown), and a compressor to pressurise the air or gas supplied to the inlet port(s). The compressor may be of the sliding-vane type, Figure 3 (not shown), and be driven directly by the rotor.
<IMAGE>